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enhanced by an exposition of A. B. Porter's work on the nature of optical images, by the author's clever vectorial treatment of secondary maxima in grating spectra, by an account of the Echelette grating, and by a new viewpoint from which to regard Talbot's fringes—all of which have recently appeared in the *Philosophical Magazine*. The discussions of interference and polarization remain almost intact. A brief but entirely new chapter is here given to "Meteorological Optics."

The beautiful method of focal isolation by which Rubens and Wood have recently been enabled to measure heat waves which are more than one tenth of a millimeter in length, has been inserted in the chapter on the theory of dispersion. But this well illustrates the impossibility of keeping a treatise up to date; for notwithstanding the preface is dated May, 1911, the infra-red spectrum has since then been extended more than an octave and a half; so that now the gap between the electrical and optical spectra is something less than three octaves—the difference between a third of a millimeter and two millimeters.

Interesting additions, dealing with the absorption of gases, have been made to Chapter XV., including Wood's extension of Balmer's series for sodium vapor absorption lines to the 48th member.

The discussion of magneto-optics has been greatly and properly enlarged, and is followed by an entirely new chapter on electro-optics.

Chapter XX., dealing with fluorescence and related phenomena, has a long title of nine words which, in the opinion of your reviewer, might well be replaced with the single term "Photo-luminescence." The Laws of Radiation (Ch. 21) have been made to include the recent achievement of Lebedew in demonstrating experimentally that a beam of light exerts a definite pressure upon an absorbing gas.

The remainder of the volume differs little from the former edition except that a final chapter on the principle of relativity has been added. But to attempt an elementary exposition of the ideas of Einstein and Minkowski in twelve small pages is well nigh attempting the impossible. Lack of consecutive-

ness makes this last chapter the only unsatisfactory one in the entire volume.

Of the book as a whole it ought to be remarked that it teems with practical hints of great value, clever bits of experimental experience from the large fund for which the professor of experimental physics in Johns Hopkins University is justly celebrated. The policy of the author in maintaining a quantitative discussion throughout, and yet refraining from the use of very advanced or severe or complicated mathematical methods, is to be highly commended. It is a matter of constant surprise to find what a large proportion of all really important phenomena can be described by very simple differential equations and can be discussed by the ordinary analysis. This remark is, of course, only intended to apply to the mathematical method of a treatise for students of physics, and not to an original paper describing the results of a mathematical investigation.

A work so altogether admirable as this should not be marred by so many typographical errors and incomplete references. Sometimes one is referred merely to "*Phil. Mag.*," at other times, as for instance in Runge's exquisite treatment of the concave grating, p. 233, one is merely told that the discussion is "due to Runge." Economy of energy on the part of the reader will be greatly served by the correction of many of these slight matters in a future revision.

However views may diverge as regards the treatment of various topics in this volume, there can surely be no difference of opinion among English-speaking students as regards the generosity which Professor Wood has shown in taking time and energy from a strenuous life of research to prepare this clear, scholarly and thoroughly modern treatise. Appreciation of this can hardly fail to show itself in a long and wide-spread use of the book.

HENRY CREW

Atlas of Zoogeography. By J. G. BARTHOLOMEW, W. EAGLE CLARK and PERCY H. GRIMSHAW. Series title: *Bartholomew's Physical*

Atlas. Volume V. 46.5 cm. Published under the patronage of the Royal Geographical Society, Edinburgh. 1911.

This handsome folio contains a limited text and "a series of maps illustrating the distribution of over seven hundred families, genera and species of existing animals." The text is divided as follows: I., General Principles of Distribution (2½ pp.); II., Historical and Geographical (8½ pp.); III., Zoological (44 pp.); and Bibliography (11 pp.). The 36 double-page plates following are mostly divided to include six world maps each, thus making about 200 maps in all. "All the families of mammals, birds, reptiles and amphibians, together with several of the more important genera and species, have been dealt with, while the work embraces in addition most of the families of fishes and a selection of families and genera of molluscs and insects." Two plates show the zoogeographical regions according to various authors, while another indicates diagrammatically the vertical and latitudinal distribution of life and inset maps illustrate prevailing vegetation, ocean currents and bathy-orographical configuration.

As a contribution to the subject of zoogeography, the work makes no serious pretensions, being strictly a compilation from existing published data, and as such is to be judged like a geography or a dictionary. In scope and finish, it surpasses anything previously attempted and will doubtless fill in large measure the place which has long been waiting for such a work, both in special and in general libraries. The great advances in knowledge of the distribution of life made in recent decades render a graphic accounting of this sort particularly welcome. The difficulties of fully attaining the desired object, however, are very great. Many groups, even of the higher vertebrates, have not been thoroughly studied from the distributional standpoint and only in few instances are the data to be found collated for use. Instead they are widely scattered, often extending into the literature of several tongues and variously concealed among irrelevant matter. On this account, perhaps one should not assume too critical an attitude

toward the detailed results of a necessarily involved task subject to the limitations of time and generalized authorship. To be beyond particular criticism, such a comprehensive work could be produced only by the combined effort of a number of specialists.

One may readily understand and excuse omissions in a work of this nature, but gratuitous extensions of distribution can not be passed so lightly, for misgivings arise as to the methods pursued. The authority, for example, which led to the extension of the range of the jaguar over the whole peninsula of Lower California must have been one which stated things in very general terms. The same may be said of carrying the distinctive color for the raccoon up the coast of British Columbia and Alaska to the base of the Alaska peninsula—a matter of over 1,000 miles of distribution without basis in fact. That this is not a mere slip is indicated by a statement of the same error in the text. The sewellels (*Aplodontia*) are given a range from Puget Sound to San Diego and the pocket gophers (*Geomys*) cover Vancouver Island and the coast of British Columbia north to the southern boundary of Alaska, considerable deviations from the real conditions. Although the reviewer has given more hasty and less competent scrutiny to the maps of groups other than the Mammalia, there are indications that no greater degree of accuracy obtains among them. One instance may be cited in the Insecta in the ranges of the well-known genera of mosquitoes, *Anopheles* and *Stegomyia*. The former is carried north to Hudson Bay and the latter to central Wisconsin, both somewhat beyond the limits known. In view of these shortcomings and others which might be mentioned, it is evident the maps can not be trusted for finer points of distribution; but they are so well executed and so useful in their general bearings that one almost feels tempted to withhold detailed criticism.

The text is brief but somewhat more than a mere explanation of the maps. In discussing the general subject, it is interesting to note that although they adopt the classic divisions of Wallace and accord first and most promi-

ment place to his map, the authors have not been able to avoid various parenthetical and semi-apologetic references to the "holarctic." The divisions of Sclater, made in 1857, are introduced as the beginnings of zoogeography and no mention is made of the much earlier work of Wagner in 1844¹ nor of the map published by Agassiz in 1854.² The groups illustrated by the maps are taken up in systematic order in the zoological text, the number of species in each is stated, peculiarities of distribution are mentioned, and brief statements are given of the character and habits of the animals. In addition, the number of fossil forms in each is stated. The distribution of fossil forms is not illustrated and only the present range is shown of animals that have become restricted during historic times. The bibliography is conveniently classified according to regions and groups and is rather extensive, although necessarily consisting of selected titles, since the number of publications having some pertinence is almost unlimited. Certain important papers are omitted, however, and many rather inconsequential ones have a place. Under Neotropical Region, one notes with some surprise the absence of any reference to such important works as Azara's "Paraguay," Tschudi's "Fauna Peruana," Maximilian's "Naturgeschichte," Castelnau's "Expedition," and Darwin and Waterhouse's "Zoology of the Voyage of the Beagle."

As a book, the atlas is very pleasing. The binding, paper, typography and arrangement are excellent. All the maps are mounted on linen-hinged tabs and the colors employed in limiting the distribution areas are soft and harmonious. That it will have a large sphere of usefulness is unquestionable and in spite of what must be said as to looseness of detail, a large measure of gratitude is due the authors for having performed the prodigious labor involved and produced a work on such excellent general lines.

WILFRED H. OSGOOD

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¹ "Die Geographische Verbreitung der Säugethiere."

² In Nott and Gliddon's "Types of Mankind."

Der Aufbau der Skeletteile in den freien Gliedmassen der Wirbeltiere. Untersuchungen an urodelen Amphibien. By H. von EGGELING, a. o. Professor und Prosektor anatom. Anstalt Universität Jena. Gustav Fischer. 1911. Pp. 324, with 4 lithographic plates; 147 figures in the text.

The author states in the preface that he was led to undertake a broad study of the comparative anatomy and histogenesis of the skeleton and ligaments because of the unsatisfactory literature on this subject which he was able to find when beginning a course of lectures at Jena. The present volume represents the first stage of this study and contains an extensive account of the skeletal structure of the limbs of urodeles. The three questions of general bearing which the author set for himself on taking up the study were as follows:

1. "In what relation to one another stand the so-called coarse-fibrous and fine-fibrous bony substances, the 'Wurzelstock' of Gegenbaur, the cement of the teeth and Sharpey's fibers? What part do these structures take in the structure of bone, aside from a merely topographical one?"

2. "What is the phylogenetic development of the compact bony substance of long bones? How have the Haversian canals arisen, to what extent does their ontogenetic development reproduce their phylogenesis? Are biological conditions to be made out on which the development of vascular canals appears dependable?"

3. "What appears to be the phylogenetic development of enchondral ossification? In what form and under what conditions arise the marrow cavity and the bone-marrow? Where, in what form, and under what conditions do the centers of ossification of the epiphyses develop? Is there an explanation for the late, purely enchondral, ossification of the carpus and tarsus of mammals?"

The author gives a good review of the literature dealing with the questions which he postulates, then gives an account of the structure of the limb skeleton in the amphibians which he himself has studied, some twenty-